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AKADÉMIAI KIADÓ

Three new gall mite records (Acari: Acariformes: Eriophyoidea) from Hungary and supplementary description of two species

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RESEARCH ARTICLE

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ABSTRACT

Three eriophyoid species are recorded for the first time in Hungary, viz. *Paraepitrimerus erigeronsis* Xue et Hong collected from *Erigeron annuus* (L.) Pers. (Asteraceae), *Phyllocoptes parvulus* (Nalepa) from *Potentilla reptans* L. (Rosaceae) and *Aceria salicina* (Nalepa) from *Salix alba* L. (Salicaceae). In addition, supplementary description of the vagrant phyllocoptine mite, *Paraepitrimerus erigeronsis*, and the deuterogynous and leaf margin rolling *Aculus craspedobius* (Nalepa) from *Salix integra* Thunb. (Salicaceae) is provided.

KEYWORDS

Eriophyidae, *Paraepitrimerus*, tall fleabane, *Aculus*, dappled willow

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INTRODUCTION

One of the largest dicotyledonous families Asteraceae (Compositae) contains 1,911 plant genera with 32,913 accepted species names (The Plant List, 2013). The family Asteraceae is well represented in the Hungarian flora with 267 recognized species. According to Király (2009) it amounts to 9.8% of the current vascular plants of Hungary. An extraordinary range of eriophyoids occupies the plants of this family. In Hungary, 8% of the known eriophyoid species live on asteraceous hosts (Ripka, 2007), although it should be recognized that our knowledge is far from adequate. Several further species are known to occur but await study.

Xue and Hong (2005) erected the phyllocoptine genus *Paraepitrimerus* based on the following characters: basiventral femoral setae *bv* being absent on both leg pairs and having three ridges on the opisthosoma. The genus *Paraepitrimerus* Xue et Hong (Acari: Acariformes: Eriophyidae) is represented by 4 species, viz. *Paraepitrimerus sanguisorbae* Xue et Hong, *P. paeoniae* Xue et Hong, *P. erigeronsis* Xue et Hong and *P. changqingicus* Xue, Song et Hong from China and found on 3 plant families (Xue and Hong, 2005; Xue et al., 2011). The leaf vagrant *P. erigeronsis* was described from *Erigeron annuus* (L.) Pers. From the former Yugoslavia, Petanović et al. (1984) reported *Epitrimerus* sp. found on *Stenactis annua* (now=*Erigeron annuus*). In Hungary, no *Paraepitrimerus* species has yet been reported to date (Ripka, 2007, 2008). The family Salicaceae contains 54 plant genera with 1,269 accepted species names (The Plant List, 2013). *Salix* L. is one of the largest genera in the family, represented by around 400 species of deciduous trees and shrubs. Majority of them lives in the cold and temperate regions of the Northern Hemisphere. Willows are a difficult group, as high numbers of species are thought to have hybridized with at least two other species and some with many more (Király, 2009). There is a distinct eriophyoid mite fauna associated with *Salix* spp. dwelling on shoots, foliage, catkins and buds of the host plants. They cause a wide range of injuries in willows, varying from destruction of epidermal cells to formation of diverse types of galls and erinea. Approximately 90 species belonging to the families Eriophyidae and Diptilomiopidae infest willows, and 35 of them form galls (Kuczyński and Skoracka, 2005). From a historical point of view, the oldest and correct citation of an eriophyoid mite associated with willows was made in England by Murray in 1877, who observed leaf galls on sallow (*Salix caprea* L.) (Murray, 1877). He named it as *Phytoptus salicis* (now=*Aceria salicis*). In Europe, Nalepa described a large number of eriophyoid taxa (14 species and 27 forms) from *Salix* spp. (Nalepa, 1892, 1900, 1911, 1925). Because advanced microscopy has not been available in the late 19th and early 20th centuries, former descriptions contain scanty morphometric characterizations and lacking of the measurements required for typical descriptions of Eriophyoidea (Amrine et al., 2003). Majority of the willow-inhabiting species lives in the Palaearctic region. In the last three decades a fair number of eriophyoid species has been described in China (Dong and Xin, 1984; Kuang, 1997; Kuang and Pang, 1997; Kuang et al., 1991, 1994, 2005). Regarding their habit, out of the 28 *Aceria* species described from *Salix* spp. there are vagrants (*Aceria curta* Sapozhnikova, *A. intercedens* Roivainen), inquilines (*Aceria salicisincanae* (Nalepa)), gall-inducing (*Aceria salicis* (Murray), *A. salicina* (Nalepa), *A. jiangsunensis* Kuang, *A. qinghaiensis* Kuang, *A. wuzhouensis* Kuang et Yang), erineum-inducing (*Aceria effusa* (Canestrini)), leaf margin rollers (*Aceria craspedophyes* (Nalepa)) and one which causes rosetting of shoot apex (*Aceria capreae* Manson) (de Lillo, 1988; Amrine and Stasny, 1994, J. W. Amrine pers. comm. 12 November 2020). Roivainen (1949) placed *Eriophyes salicinus* Nalepa in the genus *Aceria* as *Aceria salicina* (Nal.)

n. comb., and mentioned it as free-living on the undersides of the leaves. While according to other authors *Aceria salicina* causes leaf rolling and inhabits catkins (Elhalawany and El-Adl, 2017). Rack (1958) designated *Aculus gemmarum* and *Aculus tetanothrix* in the genus *Aceria*. Farkas (1965) accepted it. *Aculus tetanothrix* is known as a gall-inducing species on a wide range of plants belonging to the genus *Salix* (Szydło et al., 2010). The deuterogynous species has a wide distribution. In Hungary, out of the 19 currently known species from willow species there are eight *Aculus* spp. viz. *Aculus craspedobius* (Nalepa), *A. gemmarum* (Nalepa), *A. magnirostris* (Nalepa), *A. myrsinitis* (Roivainen), *A. parvus* (Nalepa), *A. salicisalbae* (Nalepa), *A. tetanothrix* (Nalepa) and *A. variabilis* (Roivainen) (Ripka, 2007). From *Salix integra*, only *Epitrimerus integrae* Xue, Song et Hong is known (Xue et al., 2007; Song et al., 2008). In Hungary recently, *Aculus tetanothrix* (Nalepa) was also reported from *Salix integra* (Ripka, 2016).

Because Nalepa's diagnosis (1925) on *A. craspedobius* is fairly incomplete, the objective of this paper was to provide supplementary description of protogyne female, male and deutogyne female of *Aculus craspedobius*, and female and male of *Paraepitrimerus erigeronsis* which were collected in Hungary.

MATERIAL AND METHODS

This study is part of a larger investigation on plant-inhabiting mites in Hungary. In the frame of this project eriophyoid mite fauna of different herbaceous and woody plant species was studied from occasional plant samples collected in Budapest and different counties of Hungary, between 2017 and 2020. The plant material (including leaves, petioles, stems, buds, flowers and fruits) was collected and placed in plastic bags by E. Kiss and G. Ripka, then taken to the laboratory and examined under a stereo dissecting microscope (Zeiss Stemi 2000-C, Germany). Eriophyoid mites found were placed directly into 88% lactic acid with the aid of a bent insect pin. Then they were cleared in lactic acid at room temperature and slide-mounted in Keifer's F-medium with sorbitol without adding additional fibres (Keifer, 1975). The slide-preparations were dried and then sealed with commercial nail varnish (Upton, 1991). Besides, senior author re-examined the previously collected and slide-mounted willow-inhabiting *Aceria* specimens. Specimens were examined with the aid of a research phase contrast compound microscope (Nikon Eclipse E600, Japan) equipped with a drawing tube (Nikon Y-IDT).

The generic classification follows Amrine et al. (2003), and comparisons were also made with new genera described since that publication. The terminology of external morphology and setal notation adopted for the morphological description herein follows mainly Lindquist (1996). The number of measured specimens (n) is given within parentheses in the description. All measurements of mites were made according to Amrine and Manson (1996) using an ocular micrometre eyepiece and are given in micrometres (μm). Measurements and means are rounded off to the nearest integer, when necessary. All measurements, unless specified otherwise, refer to the lengths of the morphological characters. For females the mean and ranges, for males and immature stages, only the ranges are given except in cases of constant value.

The names of the plant taxa are used according to Király (2009).

The slide mounts of the species are deposited in the collection of the Directorate of Plant Protection, Soil Conservation and Agri-environment, National Food Chain Safety Office, Budapest, Hungary.

TAXONOMY
Family ERIOPHYIDAE Nalepa
Subfamily Phyllocoptinae Nalepa
Genus *Paraepitrimerus* Xue et Hong
Paraepitrimerus erigeronsis Xue et Hong, 2005
(Fig. 1)

Paraepitrimerus erigeronsis — Xue and Hong, 2005: 5–7.

FEMALE – Body fusiform, 190 (187–212, $n = 7$), 75 (74–80) wide, 77 (75–79) thick. Gnathosoma 26 (23–29), projecting obliquely downwards; chelicerae 23 (22–24); dorsal palp genual setae *d* considerably long and angled, 17 (17–18), non-bifurcate (simple); pedipalp coxal setae *ep* 2 (2–3), pedipalp tarsal setae ν 2 (1–2). Prodorsal shield 71 (69–73) including frontal lobe, 70 (69–73) wide, subtriangular, with a frontal lobe 15 (13–15) over gnathosomal base, tip and ventral edge of lobe rough and serrate, with granules; shield pattern consists of two faint, incomplete admedian lines beginning close to posterior margin of the shield, slightly diverging to rear margin, and a faint, incomplete submedian line on each side. Tubercles of scapular setae *sc* 13 (12–16) ahead of rear shield margin, 16 (15–17) apart, setae *sc* 5 (4–5), directed up and projecting centrad.

Legs with all usual segments present. Leg I 42 (40–43), femur 12 (10–12), basiventral femoral seta *bv* absent; genu 6 (5–6), antaxial genual setae *l″* 32 (30–36); tibia 10 (10–12), paraxial tibial setae *l′* located at 1/4 (1/4–1/3) from dorsal base, 4 (4–5), very fine; tarsus 6 (6–7), paraxial unguinal tarsal setae *u′* 4 (no range), paraxial fastigial tarsal setae *ft′* 22 (14–22), antaxial fastigial tarsal setae *ft″* 26 (20–26); tarsal solenidion ω 5 (5–6), straight, distally knobbed; empodium simple, bilaterally symmetrical, 5 (no range), with 4 paired rays.

Leg II 40 (37–40), femur 12 (11–14), basiventral femoral setae *bv* absent; genu 5 (5–6), antaxial genual setae *l″* 9 (8–11) very fine; tibia 9 (9–10); tarsus 5 (5–6), paraxial unguinal tarsal setae *u′* 3 (3–4), paraxial fastigial tarsal setae *ft′* 5 (4–6), antaxial fastigial tarsal setae *ft″* 23 (21–24); tarsal solenidion ω 5 (5–6), straight, distally knobbed; empodium simple, bilaterally symmetrical, 5 (no range), with 4 paired rays.

Coxal plates with several faint longitudinal and curved lines and dashes; setae *1b* 11 (8–12), tubercles *1b* 15 (12–17) apart; setae *1a* 25 (17–35), tubercles *1a* 8 (7–9) apart; setae *2a* 42 (30–47), very fine, tubercles *2a* 25 (24–28) apart. Prosternal apodeme not well defined, because coxae I are not entirely fused. Therefore not a sternal line but two ridges present (11–13). Subcapitular (suboral) plate with tiny granules, protruding or swelling ventrally. Coxigenital area with 10 (9–11) very narrow semiannuli bearing tiny rounded microtubercles before epigynium.

Dorsal opisthosoma with three longitudinal ridges, 45 (43–47) smooth dorsal semiannuli, 70 (66–75) microtuberculate ventral semiannuli, dorsal opisthosoma evenly arched. Microtubercles fine points on rear annular margins ventrally, elongate on rear 6–7 ventral annuli. Opisthosomal setae *c2* 23 (18–27), on annulus 13 (11–13), 55 (50–57) apart; setae *d* 38 (31–39), on annulus 28 (25–31), 38 (38–40) apart; setae *e* 17 (15–20), on annulus 50 (45–55), 17 (16–20) apart; setae *f* 28 (25–31), on annulus 64 (60–69), or 7 (6–7) from rear, 22 (21–24) apart. Setae *h2* 83 (72–94), 10 (no range) apart; setae *h1* 3 (2–3), very thin, 5 (no range) apart. Caudal lobes slightly bend upward.

External genitalia 20 (17–20), 24 (23–26) wide. Female genital coverflap at base with granules and 12 (11–14) very faint interrupted, uneven lines of granules; setae *3a* 17 (14–19), 14 (13–15) apart. Internal genitalia ($n = 3$). Anterior (transverse) genital apodeme trapezoidal; posterior

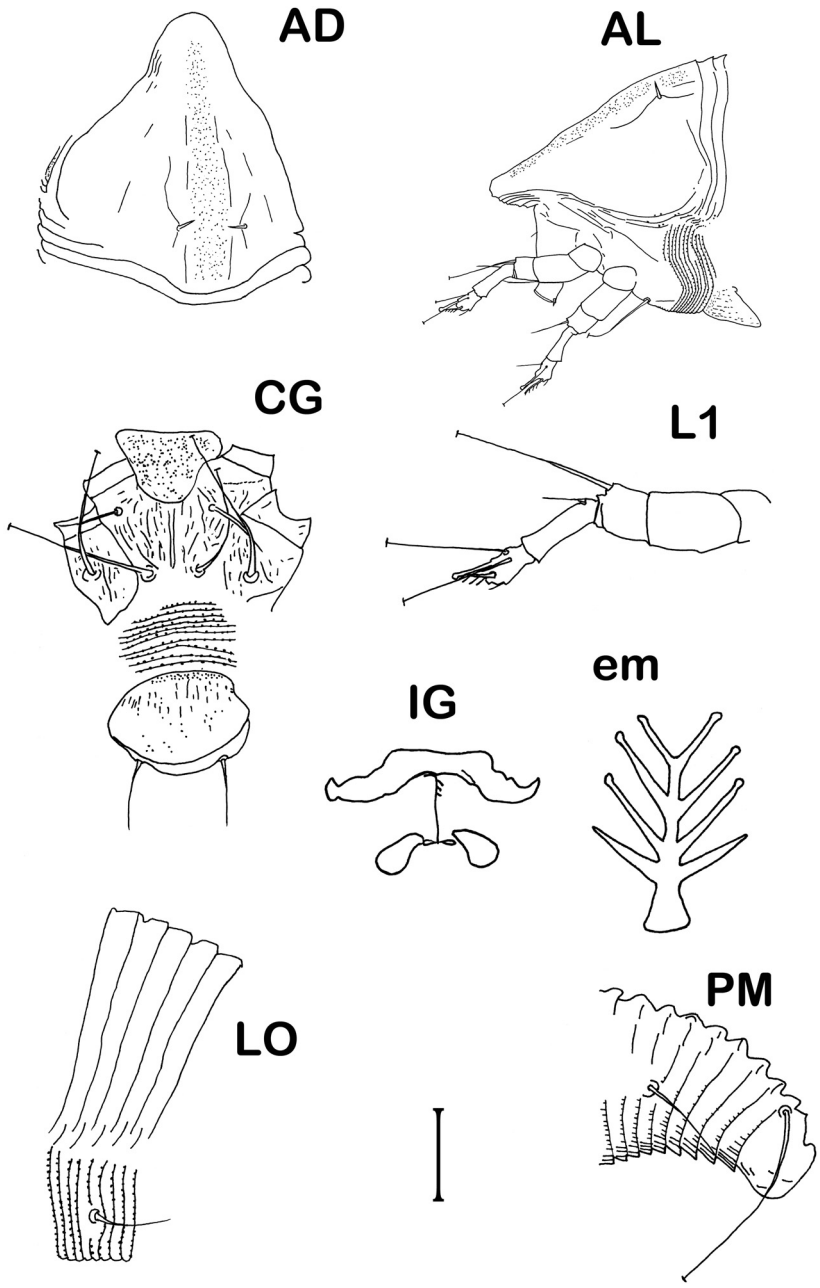

Fig. 1. Drawings of *Paraepitrimerus erigeronsis* Xue et Hong. AD—Anterodorsal mite; AL—Lateral view of anterior body region and legs; CG—Female coxigenital region; em—empodium; IG—female internal genitalia; LO—lateral view of annuli; L1—leg I; PM—lateral view of posterior opisthosoma. Scale bars: AD, AL = 22 μm; CG = 17 μm; em = 2 μm; IG = 11 μm; L1 = 12 μm; LO = 22 μm; PM = 24 μm

part of anterior genital apodeme and sclerotized, short carina present. Longitudinal bridge relatively long 8–9. Spermathecae drop-shaped or pear-shaped.

MALE – Similar to female, 154 (n = 1), 59 thick. Gnathosoma 24, projecting obliquely downwards; dorsal palp genual setae *d* 20, pedipalp coxal setae *ep* 2, pedipalp tarsal setae *v* 2, chelicerae 20. Prodorsal shield 55, with frontal lobe 10, tip and ventral edge of lobe rough and serrate; granules laterally on the shield, ornamentation similar to female. Tubercles of scapular setae *sc* 11 ahead of rear shield margin, setae *sc* 5, directed up and projecting centrad. Minute granules situated in 3 lateral rows on epicoxal areas. Leg I 37, femur 10, basiventral femoral setae *bv* absent; genu 6, antaxial genual setae *l″* 29; tibia 10, paraxial tibial setae *l′* located at 1/4 from dorsal base, 3, very fine; tarsus 5, unguinal tarsal setae *u′* 2, paraxial fastigial tarsal setae *ft′* 10, antaxial fastigial tarsal setae *ft″* 20; solenidion *ω* 5, straight, distally knobbed; empodium simple, bilaterally symmetrical, 5, 4-rayed. Leg II 35, femur 12, basiventral femoral setae *bv* absent; genu 5, antaxial genual setae *l″* 9, very fine; tibia 7; tarsus 5, unguinal tarsal setae *u′* 2, paraxial fastigial tarsal setae *ft′* 3, antaxial fastigial tarsal setae *ft″* 17; solenidion *ω* 5, straight, distally knobbed; empodium simple, bilaterally symmetrical, 5, 4-rayed. Coxisternae I and II with few dim lines; setae *1a* 13, setae *2a* 27. Subcapitular (suboral) plate protruding or swelling ventrally. Coxigenital area with 10 microtuberculate semiannuli. Dorsal opisthosoma with three longitudinal ridges, 45 smooth dorsal, 70 microtuberculate ventral semiannuli. Between the subdorsal ridges, or between the longitudinal lines of scapular tubercles *sc* the dorsal annuli smooth. Laterally and ventral semiannuli with minute microtubercles on rear annular margins, except for 5–6 ventral annuli of anal lobes, which are elongate and linear. Small and denser microtubercles ventrally. Caudal lobes normal in size and shape. Setae *c2* 14, on ventral annulus 13; setae *d* 20, on ventral annulus 30; setae *e* 7, on ventral annulus 47; setae *f* 23, on ventral annulus 63 or 7 from rear. Setae *h1* 2. External genitalia 14, setae *3a* 13.

NYMPH unknown.

Host plant – Tall fleabane, *Erigeron annuus* (L.) Pers. (Asteraceae); an invasive annual weed of North American origin.

Relation to the host plant – The vagrant mite was found on leaves. No apparent damage was observed.

Hungarian locality – Kétbodony, Nógrád county, Northern Hungary, 47.930022 N, 19.283616 E, 159 m above sea level. The host plant species, *E. annuus* grows by the roadside.

Material examined – The supplementarily described female among 3 females and 1 male (slide # 1489a), 2 females (slide # 1489b) coll. Enikő Kiss, 29. IX. 2019. Deposited at the Directorate of Plant Protection, Soil Conservation and Agri-environment, National Food Chain Safety Office, Budapest, Hungary.

Remarks – The morphometry of the Hungarian specimens supplementarily described herein closely corresponds to the original description (Xue and Hong, 2005), apart from differences in some morphometric parameters: the body length 187–212 (whereas 245 in *P. erigeronsis*), the length of prodorsal shield 69–73 (apparently 58 in *P. erigeronsis*), length of leg I 40–43 and leg II 37–40 (whereas, 33 and 29, respectively in *P. erigeronsis*). In addition, prodorsal shield with two faint incomplete admedian lines and a faint incomplete submedian line in the Hungarian specimens (prodorsal shield smooth in *P. erigeronsis*), and *P. erigeronsis* has longer opisthosomal setae *e* 31 and *f* 60 (*versus* 15–20 and 25–31, resp. in Hungarian specimens). It should be noted that the length and shape of dorsal palp genual setae *d* of *P. erigeronsis* were not described and illustrated by Xue and Hong (2005). Later Xue et al. (2011) described the dorsal palp genual

setae *d* of another *Paraepitrimerus* species as unbranched (*P. changqingicus* from *Aster tataricus* L. (Asteraceae)). Dr. X.-F. Xue confirmed that pedipalp setae *d* of the type specimens of *P. erigeronsis* are curved but non-bifurcate (Dr. Xue pers. comm. 10 July 2020).

Genus *Aculus* Keifer
Aculus craspedobius (Nalepa, 1925)
(Figs 2–5)

Eriophyes tetanothrix craspedobius typicus n. ssp. — Nalepa, 1925: 39–40.
Aceria tetánothrix crapedóbia Nalepa (sic!) — Farkas, 1965: 49.
Aculus craspedobius (Nalepa, 1925) — Amrine and Stasny, 1994: 119, 637.

PROTOGYNE FEMALE – Body fusiform, 204 (173–222, $n = 7$), 64 (60–65) wide, 65 (63–66) thick. Gnathosoma 26 (23–28), projecting obliquely downwards; dorsal palp genual setae *d* 6 (6–7), unbranched; pedipalp coxal setae *ep* 2 (2–3) very thin; pedipalp tarsal setae *v* 1 (1–2). Chelicerae 19 (19–20). Prodorsal shield 32 (28–35), 47 (41–55) wide, trapezoid, with short, anteriorly rounded frontal lobe 7 (6–8), over gnathosomal base. Shield almost smooth, with two faint incomplete admedian lines, diverging posteriorly, more widely separate on rear $^1/_3$, two faint, incomplete submedian lines; median line faint, incomplete. Tubercles of scapular setae *sc* 2 (2–3), on rear shield margin, 25 (24–25) apart, setae *sc* 28 (25–30), diverging and directed rearwards. Epicoxal area with minute granules in 4 (3–5) rows.

Legs with all usual segments and setae present. Leg I 38 (37–40), femur 11 (10–12), basiventral femoral seta *bv* 10 (9–11); genu 5 (no range), antaxial genual seta *l″* 26 (25–27); tibia 10 (9–12), paraxial tibial seta *l′* located at 1/4 (no range) from dorsal base, 6 (6–7), very thin; tarsus 8 (7–8), unguinal tarsal setae *u′* 5 (no range); paraxial fastigial tarsal setae *ft′* 19 (15–22), antaxial fastigial tarsal setae *ft″* 24 (21–25); solenidion *ω* 8 (7–8), distally rounded, slightly curved; empodium simple, bilaterally symmetrical, 7 (6–7), 4-rayed, with additional secondary branches. Leg II 35 (34–35), femur 10 (9–10), basiventral femoral seta *bv* 8 (8–9); genu 5 (no range), antaxial genual seta *l″* 8 (8–10) very thin; tibia 8 (7–8); tarsus 7 (6–7), unguinal tarsal setae *u′* 4 (3–4); paraxial fastigial tarsal setae *ft′* 6 (5–7), antaxial fastigial tarsal setae *ft″* 22 (21–24); solenidion *ω* 7 (7–8), distally rounded, slightly curved; empodium simple, bilaterally symmetrical, 7 (6–7), 4-rayed, with additional secondary branches.

Coxigenital area with 8 (7–9) microtuberculate semiannuli. Coxisternae I and II with few, faint longitudinal lines, dashes and tiny granules; anterior setae on coxisternum I, *1b* 9 (8–11), tubercles setae *1b* 13 (11–15) apart, proximal setae on coxisternum I, *1a* 22 (20–25), tubercles setae *1a* 8 (7–8) apart, proximal setae on coxisternum II, *2a* 36 (28–42), tubercles setae *2a* 25 (23–27) apart. Subcapitular (suboral) plate small and rounded cordate, without distinct ornamentation. Prosternal apodeme 11 (10–12). Opisthosoma with 64 (53–67) dorsal semiannuli with very faint, minute microtubercles, and 70 (67–74) microtuberculate ventral semiannuli. Small, round microtubercles on rear annular margin ventrally. Last 4–5 ventral annuli with linear microtubercles. Opisthosomal setae *c2* 22 (18–25), on annulus 12 (12–14), 56 (54–60) apart; opisthosomal setae *d* 54 (52–58), on annulus 27 (25–30), 36 (35–38) apart; opisthosomal setae *e* 20 (20–22), on annulus 46 (44–50), 20 (18–23) apart; opisthosomal setae *f* 29 (28–31), on annulus 65 (62–69), or 6 (5–6) from the rear, 25 (24–27) apart. Setae *h2* 87 (76–100), very thin at apex, 9 (9–10) apart; setae *h1* 4 (3–4), 5 (no range) apart. Anal lobes normal.

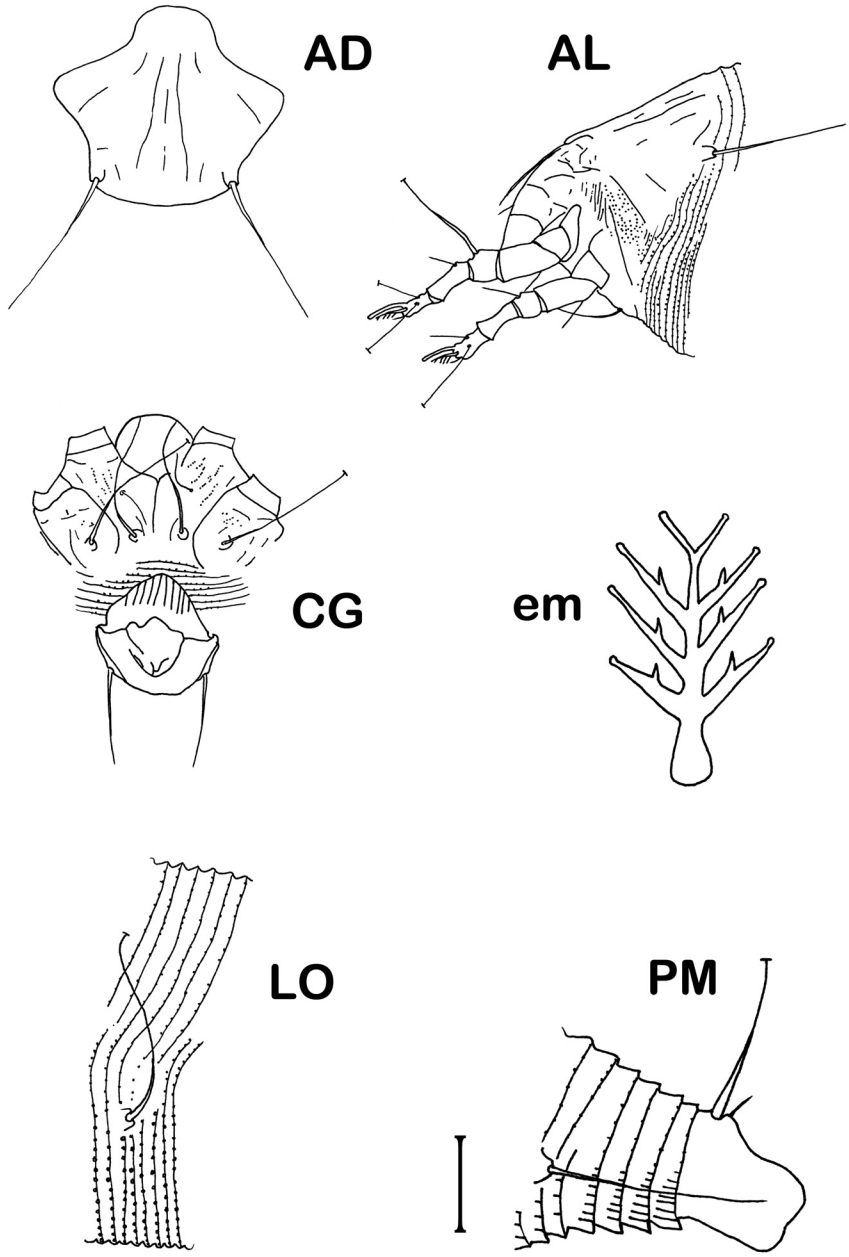

Fig. 2. Drawings of *Aculus craspedobius* (Nalepa), protogyne female. AD—Anterodorsal mite; AL—Lateral view of anterior body region and legs; CG—Female coxigenital region; em—empodium; LO—lateral view of annuli; PM—lateral view of posterior opisthosoma. Scale bars: AD = 15 μm; AL, CG = 17 μm; em = 2 μm; LO, PM = 13 μm

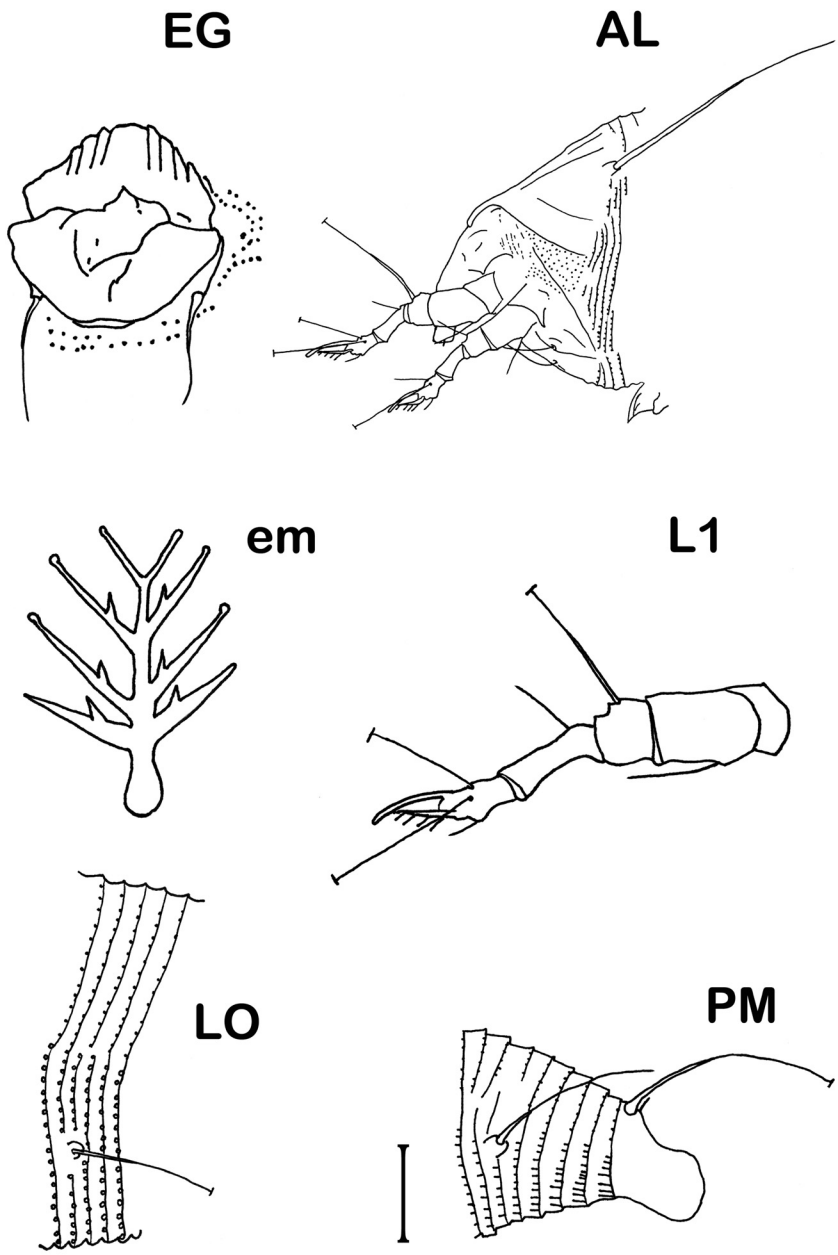

Fig. 3. Drawings of *Aculus craspedobius* (Nalepa), deutogyne female. AL—Lateral view of anterior body region and legs; em—empodium; EG—female external genitalia; LO—lateral view of annuli; L1—leg I; PM—lateral view of posterior opisthosoma. Scale bars: AL = 18 μm; EG = 10 μm; em = 2 μm; L1 = 9 μm; LO = 11 μm, PM = 14 μm

External genitalia 17 (15–19), 22 (20–24) wide. Base of female genital coverflap with 3 (2–4) microtuberculate rings, and 11 (10–11) longitudinal ridges; coxisternal III setae *3a* 18 (17–19) apart, 41 (29–52), very thin. Internal genitalia ($n = 3$). Anterior (transverse) genital apodeme trapezoidal. Spermathecae globular or ovoid.

MALE – Similar to female, 167–200 ($n = 3$), 60–65 thick. Gnathosoma 27–30, projecting obliquely downwards; dorsal palp genual setae *d* 4–5, unbranched; pedipalp coxal setae *ep* 2 (no range) very thin; pedipalp tarsal setae *v* non apparent. Prodorsal shield 30–38, 40–47 wide, trapezoid, with short, anteriorly rounded frontal lobe 4–6, ornamentation similar to female. Tubercles of scapular setae *sc* 2–3 on rear shield margin, setae *sc* 25–27, diverging, directed rearwards. Minute granules situated in 4–5 lateral rows on epicoxal areas. Leg I 28–35, femur 10 (no range), basiventral femoral setae *bv* 7–8, very fine; genu 5 (no range), antaxial genual setae *l″* 25–27; tibia 8–10, paraxial tibial setae *l′* located at 1/5–1/4 from dorsal base, 4–5, very fine; tarsus 5–7, unguinal tarsal setae *u′* 3–5, paraxial fastigial tarsal setae *ft'* 13–15, antaxial fastigial tarsal setae *ft"* 18–22; solenidion *ω* 7–8, slightly curved, distally rounded; empodium simple, bilaterally symmetrical, 5–6, 4-rayed. Leg II 25–27, femur 7–8, basiventral femoral setae *bv* 7–9, very fine; genu 4–5, antaxial genual setae *l″* 5–6, very fine; tibia 7 (no range); tarsus 4–5, unguinal tarsal setae *u′* 3–5, paraxial fastigial tarsal setae *ft'* 5–6, antaxial fastigial tarsal setae *ft"* 20–21; solenidion *ω* 7 (no range), slightly curved, distally rounded; empodium simple, bilaterally symmetrical, 6 (no range), 4-rayed. Coxisternae I and II with few dim lines and dashes; setae *1b* 5–6, setae *1a* 12–14, setae *2a* 25–27, all very fine. Subcapitular (suboral) plate small and anteriorly rounded. Coxigenital area with 7–8 microtuberculate semiannuli. Prosternal apodeme 11–12. Opisthosoma with 60–65 microtuberculate dorsal, 67–70 microtuberculate ventral semiannuli. Round microtubercles located on rear margin of each dorsal and ventral annulus; elongate and linear microtubercles on last 4–5 ventral annuli of anal lobes. Caudal lobes normal in size and shape. Setae *c2* 12 (no range), on ventral annulus 12–13; setae *d* 30–39, on ventral annulus 26–28; setae *e* 20 (no range), on ventral annulus 41–45; setae *f* 25–27, on ventral annulus 62–65, or 5 (no range) from rear. Setae *h2* 60–65; setae *h1* 3. External genitalia 14–17, posterior ½ with minute granules, setae *3a* 21–25, tiny eugenital setae present.

NYMPH unknown.

Host plant – dappled willow, flamingo willow, shrimp willow, Japanese dappled willow, or Japanese variegated willow, *Salix integra* Thunb. (Salicaceae), an ornamental deciduous shrub or small tree, native to north eastern China, Japan, Korea and the far southeast of Russia.

Relationship to the host plant – Protogyne and deutogyne females of *A. craspedobius* were collected from the lower side of the leaves with downwards rolled leaf margins and beadlike, often irregularly rounded galls of pale yellow and greenish-yellow colours (Figs 4 and 5). The non-indigenous ornamental willow species, *Salix integra* is a new host for *A. craspedobius*.

Hungarian locality – Eger, Heves county, Northern Hungary in a private garden, 47.901402 N, 20.381969 E, 180 m elev.

Material examined – The supplementarily described protogyne female among 6 protogynes and one male, and 2 deutogynes of *A. craspedobius* (slide # 1494a), 4 protogynes and 6 deutogynes of *A. craspedobius* (slide # 1494b), 2 protogynes and 2 males, and 1 deutogyne of *A. craspedobius* (slide # 1494c), 4 protogynes and one male, and 2 deutogynes of *A. craspedobius* (slide # 1494d) and 9 protogynes and one male, and 4 deutogynes of *A. craspedobius* (slide # 1494e) coll. G. Ripka, 07. VI 2020. Slides are in the corresponding author's collection and

Fig. 4. Leaf edge roll and galls on *Salix integra* caused by *Aculus craspedobius* (Nalepa). (*Photo*: dr. László Érsek)

Fig. 5. Leaf edge roll and galls on *Salix integra* caused by *Aculus craspedobius* (Nalepa). (*Photo*: dr. László Érsek)

deposited at the Directorate of Plant Protection, Soil Conservation and Agri-environment, National Food Chain Safety Office, Budapest, Hungary.

DEUTOGYNE FEMALE – Body fusiform, 177 (147–222, $n = 6$), 63 (60–67) thick. Gnathosoma 28 (25–30), projecting obliquely downwards; dorsal palp genual setae *d* 6 (5–7), unbranched; pedipalp coxal setae *ep* 2 (2–3), very thin; pedipalp tarsal setae *v* 1 (1–2). Chelicerae 20 (19–20). Prodorsal shield 34 (32–35), 42 (40–46) wide, trapezoid, with anteriorly rounded frontal lobe 7 (6–8), over gnathosomal base. Shield almost smooth, with two faint, incomplete admedian lines, diverging posteriorly, more widely separate on rear $^{1}/_{3}$, two faint, incomplete submedian lines; indistinct, incomplete median line. Tubercles of scapular setae *sc* 3 (2–3), on

rear shield margin, setae *sc* 59 (55–61), diverging and directed rearwards. Epicoxal area with tiny granules in 4 (4–5) rows.

Legs with all usual segments and setae present. Leg I 35 (34–36), femur 9 (8–10), basiventral femoral seta *bv* 9 (8–11); genu 5 (no range), antaxial genual seta *l″* 27 (26–28); tibia 10 (no range), paraxial tibial seta *l′* located at 1/4 (no range) from dorsal base, 6 (5–6), very thin; tarsus 7 (7–8), unguinal tarsal setae *u′* 3 (3–4); paraxial fastigial tarsal setae *ft′* 17 (15–18), antaxial fastigial tarsal setae *ft″* 24 (23–25); solenidion *ω* 7 (7–8), distally rounded; empodium simple, bilaterally symmetrical, 6 (6–7), 4-rayed, with additional secondary branches. Leg II 32 (30–35), femur 9 (8–10), basiventral femoral seta *bv* 8 (7–9); genu 5 (no range), antaxial genual seta *l″* 8 (7–9) very thin; tibia 8 (7–8); tarsus 7 (no range), unguinal tarsal setae *u′* 3 (3–4); paraxial fastigial tarsal setae *ft′* 7 (6–7), antaxial fastigial tarsal setae *ft″* 20 (18–22); solenidion *ω* 8 (7–8), distally rounded; empodium simple, bilaterally symmetrical, 6 (no range), 4-rayed, with additional secondary branches.

Coxigenital area with 7 (6–8) microtuberculate semiannuli. Coxisternum I with few, faint granules, coxisternum II with few, faint granules, longitudinal lines; anterior setae on coxisternum I, *1b* 8 (6–10), proximal setae on coxisternum I, *1a* 16 (13–22), proximal setae on coxisternum II, *2a* 34 (28–45). Subcapitular (suboral) plate small and rounded cordate, without distinct ornamentation. Prosternal apodeme 11 (11–12).

Opisthosoma with 60 (57–66) dorsal semiannuli with extremely faint, minute microtubercles, and 70 (67–75) microtuberculate ventral semiannuli. Small, round microtubercles on rear annular margin ventrally. Last 5–6 ventral annuli with linear microtubercles. Opisthosomal setae *c2* 15 (14–16), on annulus 13 (12–13); opisthosomal setae *d* 40 (35–44), on annulus 28 (25–29); opisthosomal setae *e* 21 (20–22), on annulus 46 (42–50); opisthosomal setae *f* 27 (25–30), on annulus 66 (62–70), or 5 (5–6) from the rear. Setae *h2* 88 (70–101), very thin at apex; setae *h1* 3 (3–4). Anal lobes normal.

External genitalia 17 (16–18), 23 (22–23) wide. Base of female genital coverflap with 3 microtuberculate rings, and 11 (10–11) longitudinal ridges; coxisternal III setae *3a* 30 (23–40), very thin. Internal genitalia ($n = 3$). Anterior (transverse) genital apodeme trapezoidal. Spermathecae globoid or ovoid.

Host plant – dappled willow, *Salix integra* Thunb. (Salicaceae).

Relationship to the host plant – Deutogyne females of *A. craspedobius* were collected by G. Ripka, 07. VI. 2020, from the lower side of the leaves with downwards rolled leaf margins and beadlike, often irregularly rounded galls of pale yellow and greenish-yellow colours (Figs 4 and 5).

Hungarian locality – Eger, Heves county, Northern Hungary in a private garden, 47.901402 N, 20.381969 E, 180 m elev.

Remarks

Because of the hybridization of different *Salix* species, creating confusion as to their correct identity, at present there is some uncertainty as to whether which *Salix* species are the host plants of the different *Aceria* spp. and *Aculus* spp., and what kind of symptoms was caused by the respective eriophyoid species. The inadequate or poor description of the old species given by Canestrini, Nalepa, Pagenstecher and their contemporaries led to considerable uncertainty and confusion over the last century. Moreover the identifications of specimens to species were

uncertain in most early cases without comparison with type-material, and because the identifications based mostly on qualitative characters of females, lacking of the morphometric characterizations of females, males and immature stages.

As an example, Roivainen (1953) described *Vasates variabilis* (now=*Aculus variabilis* (Roiv.)) from *Salix daphnoides*. It should be noted that he observed two forms: an 'Eriophyine stage' and a 'Phyllocoptine stage', which differ in several characters, e.g. length and width of the body, length of prodorsal shield, rostrum, foreleg, tibia, opisthosomal setae and number of annuli (Roivainen, 1953). He mentioned that the 'Eriophyine stage' was very similar to *Aceria gemmarum* (Nal.) (now=*Aculus gemmarum* (Nalepa)). The two forms were probably protogyne and deutogyne females. In another paper, re-describing *Vasates parvus* (Nal.) (now=*Aculus parvus* (Nalepa)) from *Salix repens*, he stated that many willow-inhabiting eriophyoid species were very variable (Roivainen, 1951).

The situation is very similar in case of the remarkable diverse eriophyoid mite communities associated with *Acer*, *Quercus*, *Tilia* and *Ulmus* spp. The aim of this paper is to give indisputable certainty of the identity of *Aculus craspedobius*. The male is characterized for the first time. At first sight the shape of prodorsal shield of *A. craspedobius* is similar to that of *Mitratus* Kuang (Acari: Eriophyidae), but the later has a distinct posterior shield lobe (whereas posterior lobe absent in *A. craspedobius*). While it may be not easy to identify a given *Aculus* mite to genus, it is much more difficult to identify it to species because more than 260 species are known (Amrine et al., 2003). There are some morphometric differences between the examined Hungarian *A. craspedobius* specimens and the original description given by Nalepa (1925). We especially draw attention to the length of prodorsal shield, setae *sc* and setae *d* (38, 35 and 35, resp. in holotype of *A. craspedobius*) differing from that of the Hungarian specimens (28–35, 26–30 and 52–58, resp.). We also note the presence of the microtubercles on the dorsal annuli: males of *A. craspedobius* have as distinct microtubercles on dorsal annuli as on ventral annuli. Nevertheless, the examined specimens globally similar and most probably belong to *A. craspedobius* because the vast majority of the morphometric parameters for protogyne female match the original description given by Nalepa (1925).

In the mite population collected from the leaf margin rolled leaves of *Salix integra*, the deutogyne female of *A. craspedobius* was also present which has longer seta *sc* (55–61) (apparently 26–30 in protogyne female), shorter seta *d* (35–44) (whereas 52–58 in protogyne female), subcylindrical dorsal tubercles (*vs* semiglobular dorsal tubercles in protogyne female). In the rolled leaf edges and galls there were two morphologically different forms of *Aculus* females, but only one form of male was present. In this *Aculus* population the deutogynes appear in midsummer, not only in autumn, and were present simultaneously with protogynes. There was only one form of male having with shorter seta *sc* like the protogyne female. The two forms of females are not two different species. Therefore both females are conspecific. The authors did not collect this mite in winter.

Examination of types, as well as a critical assessment of intraspecific variation based on additional specimens will be necessary to clarify species boundaries and uncover synonymies.

New records

The following two species are new for the fauna of Hungary as well:

Phyllocoptes parvulus (Nalepa, 1892) from creeping cinquefoil, *Potentilla reptans* L. (Rosaceae), a perennial plant living on road side verges, grassy areas, abandoned lawns and turf, Budapest, distr. II, by the road side, coll. Enikő Kiss, 07. VIII. 2017, 28. VIII. 2020. Females and

males of the vagrant mite were found on the underside of the leaves and caused no discernible symptoms on the host. Its empodium is 4-rayed contrary to the original description where it was 3-rayed. It is a new under surface leaf vagrant species for the fauna of Hungary.

The main characteristics of *Ph. parvulus* are as follows:

Female – Body fusiform, 167–210 (n = 8), 55–57 wide, 50–59 thick. Gnathosoma 16–19, projecting obliquely downwards. Prodorsal shield 33–40 including frontal lobe, 47–49 wide, semicircular, with a frontal lobe 2–3 over gnathosomal base; shield pattern consists of a faint, incomplete, interrupted median line, two interrupted, admedian lines beginning close to posterior margin of the shield, slightly diverging to rear margin, and two faint, incomplete, interrupted submedian lines on each side, they converge forward. Tubercles of scapular setae *sc* ahead of rear shield margin, 17–18 apart, setae *sc* 10–12, directed up and projecting centrad.

Leg I 23–28; tarsal solenidion ω distally knobbed; empodium simple, bilaterally symmetrical, with 4 paired rays. Leg II 21–26; tarsal solenidion ω distally knobbed; empodium simple, bilaterally symmetrical, with 4 paired rays.

Dorsal opisthosoma with 45–52 microtuberculate dorsal semiannuli, 55–63 microtuberculate ventral semiannuli. Dorsal opisthosoma evenly arched. Microtubercles fine points on rear annular margins ventrally, elongate on rear 4 ventral annuli. Opisthosomal setae *c2* 8–10, 45–48 apart; setae *d* 39–47, 37–38 apart; setae *e* 7–8, 17–18 apart; setae *f* 18–20, 19–20 apart. Setae *h2* 45–55; setae *h1* 2–3. Caudal lobes normal in size and shape.

External genitalia 11–16, 18–19 wide. Female genital coverflap with 8–9 ridges.

Aceria salicina (Nalepa, 1911) *sensu* de Lillo (1988) from white willow, *Salix alba* L. (Salicaceae), Budapest, distr. XV, coll. G. Ripka, 30. VIII. 1993; from *Salix alba*, Budapest, distr. XV, coll. G. Ripka, 08. IX. 1993; from *Salix alba*, Tornyosnémeti, Borsod-Abaúj-Zemplén county (Northeast Hungary), coll. G. Ripka, 11. VIII. 1994. Based on the re-examination of the previously collected and mounted willow-inhabiting *Aceria* mites, the morphometry of the studied specimens (females and males) and their symptom match the description and illustrations of *A. salicina* given by de Lillo (1988). However, the ornamentation of prodorsal shield, the striation of female genital coverflap and the shape of female internal genitalia of *A. salicina* differ in Figure 11 given by Petanović (1988). Concerning the morphological features there are some other differences in the literature. According to Nalepa (1911) and Liro and Roivainen (1951) the empodium is 5-rayed, whereas 4-rayed as Farkas (1965) stated it. It should be noted that the description of *Aceria salicis* (Murray) is completely inadequate and a species could not be identified based on it. *A. salicina* caused small beadlike yellowish-green then claret-coloured galls 1–2 mm in diameter on the upper side of the leaves. The main characteristics of *A. salicina* are as follows:

Female – Body vermiform, 177–240 (n = 8), 55–60 wide, 45–57 thick. Gnathosoma 22–25, projecting obliquely downwards. Chelicerae 17–21. Prodorsal shield 30–34, 36–44 wide, semicircular, elliptic; shield pattern consists of a faint, incomplete median line on rear 1/3–1/2, two faint, complete admedian lines beginning close to posterior margin of the shield, slightly diverging to rear margin, and two, incomplete submedian lines on each side. Many distinct dashes in 7–8 rows between the submedian line II and lateral shield margin. Tubercles of scapular setae *sc* on rear shield margin, 25–26 apart, setae *sc* 30–34, diverging and directed rearwards. Epicoxal area with tiny granules.

Leg I 31–39; tarsal solenidion ω distally knobbed; empodium simple, bilaterally symmetrical, with 6 paired rays. Leg II 28–35; tarsal solenidion ω distally knobbed; empodium simple, bilaterally symmetrical, with 6 paired rays.

Dorsal opisthosoma with 75–105 subequal, microtuberculate annuli. Microtubercles elliptical on dorsal side, bead like on rear annular margins ventrally, elongate on rear 8–10 ventral annuli. Opisthosomal setae *c2* 16–20, 47–52 apart; setae *d* 50–67, 35–39 apart; setae *e* 13–17, 21–25 apart; setae *f* 26–30, 26–30 apart. Setae *h2* 80–105; setae *h1* 7–8. Anal lobes normal in size and shape.

External genitalia 13–17, 19–20 wide. Female genital coverflap with 9–10 ridges.

Other records

Aculus argenteae (Farkas, 1963) from silver lime, *Tilia tomentosa* Moench (Tiliaceae), Budapest, distr. XI, coll. dr. Attila Haltrich, 07. IX. 2020. It was collected from the under surface of the leaves with yellowish green and brown leaf galls on the upper side and ochre and reddish erinea on the lower side. The round galls are of 2–4 mm diameter.

Aculops mosoniensis Ripka, 2014, from tree of heaven, *Ailanthus altissima* (Mill.) Swingle (Simaroubaceae), Budapest, distr. XI, coll. G. Ripka, 03. VIII. 2020 (Ripka 2014 in Ripka and Érsek 2014). It was collected from the under surface of the leaflets. The species caused severe leaf deformation and yellowing and made narrow the leaflets.

Coptophylla gymnaspis (Nalepa, 1892), *Shevtchenkella serrata* (Nalepa, 1892) and *Neotegonotus fastigatus* (Nalepa, 1892) from field maple, *Acer campestre* L. (Aceraceae), Budapest, distr. II, coll. G. Ripka, 17. VIII. 2020. They were collected from the lower side of the leaves. *Shevtchenkella serrata* (Nalepa, 1892) caused severe yellowing and rusting of the leaves.

Platyphytoptus sabinianae (Keifer, 1938), from Austrian pine, *Pinus nigra* J. F. Arnold (Pinaceae), Budapest, distr. XI, coll. G. Ripka, 30. VI. 2020 (Keifer, 1938). It was collected from the leaf sheaths. No damage was caused.

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